Assignment 5

1. Consider the language A consisting of all strings in a and b with at least as many as as bs, and the language B consisting of strings in a and b with at most as many as as bs. Show that these languages are context-free languages by constructing CFGs for them.

2. Construct a CFG for the language $L = \{a^i b^j c^k \mid i = j \text{ or } j = k\}$.

3. Show by construction why:

   i. the union of two CFGs is a CFG.

   ii. the Kleene star of a CFG is a CFG.

   iii. the concatenation of two CFGs is a CFG.

4. For the three grammars in examples 1 and 2, and using the technique described in class/the notes/the book, construct equivalent grammars that are in Chomsky Normal Form.